

Amendments

Please amend this application with respect to the matters set forth below concerning the claims:

In the Claims:

Please (a) rewrite Claims 20~22, 25~27 and 29~41; (b) cancel Claims 1~19 without prejudice to or disclaimer of the subject matter thereof; and (c) add new Claims 39~41.

The requested amendments to Claims 20~22, 25~27 and 29~41 are shown below in the Listing of Claims (contained on pages 3~12 of this paper) in a marked-up version of those claims, as required by 37 CFR §1.121(c). Deletions are shown by strike-through, and additions are shown by underlining. Also shown on pages 3~12 are new Claims 39~41, and a complete listing of all other claims indicating the status thereof.

Listing of Claims

[including (i) amendments to Claims
20~22, 25~27 and 29~38;
(ii) new Claims 39~41; and
(iii) status of all claims;
(Claims 20~22, 25~27 and 29~41 are now active)]

1 ~ 19. (cancelled).

20. (currently amended) An apparatus for analyzing a multi-component gas mixture, comprising:

(a) an array of four or more chemo/electro-active materials, each chemo/electro-active material exhibiting a different electrical response characteristic, upon exposure at a selected temperature to the gas mixture, than each of the other chemo/electro-active materials;

~~wherein the chemo/electro-active materials are selected from the group consisting of (i) the chemo/electro-active materials that comprise M^1O_x , (ii) the chemo/electro-active materials that comprise $M^1_a M^2_b O_x$, and (iii) the chemo/electro-active materials that comprise $M^1_a M^2_b M^3_c O_x$;~~

~~wherein M^1 is selected from the group consisting of Al, Ce, Cr, Cu, Fe, Ga, Mn, Nb, Nd, Ni, Pr, Sb, Sn, Ta, Ti, W and Zn;~~

~~wherein M^2 and M^3 are each independently selected from the group consisting of Ga, La, Mn, Ni, Sn, Sr, Ti, W, Y, Zn;~~

~~wherein M^1 and M^2 are each different in $M^1_a M^2_b O_x$ and M^1 , M^2 and M^3 are each different in $M^1_a M^2_b M^3_c O_x$;~~

~~_____ wherein a, b and c are each independently about 0.0005 to about 1; and~~

~~_____ wherein x is a number sufficient so that the oxygen present balances the charges of the other elements in the chemo/electro-active material; and~~

~~_____ (b) means for determining an individual electrical response of each chemo/electro-active material upon exposure of the array to the gas mixture;~~

~~_____ wherein at least four chemo/electro-active materials comprise a group of four materials selected from one of the following groups~~

~~_____ the group of chemo/electro-active materials comprising, respectively, $\text{Ga}_a\text{Ti}_b\text{Zn}_c\text{O}_x$, $\text{Nb}_a\text{Ti}_b\text{O}_x$, $\text{Ni}_a\text{Zn}_b\text{O}_x$, and SnO_2~~

~~_____ the group of chemo/electro-active materials comprising, respectively, $\text{Nb}_a\text{Ti}_b\text{O}_x$, $\text{Ni}_a\text{Zn}_b\text{O}_x$, $\text{Sb}_a\text{Sn}_b\text{O}_x$, and ZnO~~

~~_____ the group of chemo/electro-active materials comprising, respectively, $\text{Ni}_a\text{Zn}_b\text{O}_x$, $\text{Sb}_a\text{Sn}_b\text{O}_x$, $\text{Ta}_a\text{Ti}_b\text{O}_x$, and ZnO ; and~~

~~_____ the group of chemo/electro-active materials comprising, respectively, $\text{Sb}_a\text{Sn}_b\text{O}_x$, $\text{Ta}_a\text{Ti}_b\text{O}_x$, $\text{Ti}_a\text{Zn}_b\text{O}_x$, and ZnO ;~~

~~_____ wherein a, b, c and x are as set forth above; and~~

~~_____ wherein the apparatus determines the concentration within the multi-component gas mixture of ammonia and one or more nitrogen oxides, and determines the presence or concentration within the mixture of a hydrocarbon.~~

wherein at least four of the chemo/electro-active materials in the array comprise one of the following groups of four materials:

the group of chemo/electro-active materials comprising, respectively, $\text{Ga}_a\text{Ti}_b\text{Zn}_c\text{O}_x$, $\text{Nb}_a\text{Ti}_b\text{O}_x$, $\text{Ni}_a\text{Zn}_b\text{O}_x$, and SnO_2

the group of chemo/electro-active materials comprising, respectively, $\text{Nb}_a\text{Ti}_b\text{O}_x$, $\text{Ni}_a\text{Zn}_b\text{O}_x$, $\text{Sb}_a\text{Sn}_b\text{O}_x$, and ZnO

the group of chemo/electro-active materials comprising, respectively, $\text{Ni}_a\text{Zn}_b\text{O}_x$, $\text{Sb}_a\text{Sn}_b\text{O}_x$, $\text{Ta}_a\text{Ti}_b\text{O}_x$, and ZnO ; and

the group of chemo/electro-active materials comprising, respectively, $\text{Sb}_a\text{Sn}_b\text{O}_x$, $\text{Ta}_a\text{Ti}_b\text{O}_x$, $\text{Ti}_a\text{Zn}_b\text{O}_x$, and ZnO ;

wherein a, b and c are each independently about 0.0005 to about 1; and

wherein x is a number sufficient so that the oxygen present balances the charges of the other elements in the chemo/electro-active material;

(b) means for determining an individual electrical response of each chemo/electro-active material upon exposure of the array to the gas mixture; and

(c) means for obtaining, from no information about the gas mixture other than the individual electrical response of the chemo/electro-active

materials, a determination related to the presence or concentration of a component in the gas mixture.

21. (currently amended) An apparatus for analyzing a multi-component gas mixture, comprising:

(a) an array of six or more chemo/electro-active materials, each chemo/electro-active material exhibiting a different electrical response characteristic, upon exposure at a selected temperature to the gas mixture, than each of the other chemo/electro-active materials;

~~wherein the chemo/electro-active materials are selected from the group consisting of (i) the chemo/electro-active materials that comprise M^1O_x , (ii) the chemo/electro-active materials that comprise $M^1_aM^2_bO_x$, and (iii) the chemo/electro-active materials that comprise $M^1_aM^2_bM^3_cO_x$;~~

~~wherein M^1 is selected from the group consisting of Al, Ce, Cr, Cu, Fe, Ga, Mn, Nb, Nd, Ni, Pr, Sb, Sn, Ta, Ti, W and Zn;~~

~~wherein M^2 and M^3 are each independently selected from the group consisting of Ga, La, Mn, Ni, Sn, Sr, Ti, W, Y, Zn;~~

~~wherein M^1 and M^2 are each different in $M^1_aM^2_bO_x$, and M^1 , M^2 and M^3 are each different in $M^1_aM^2_bM^3_cO_x$;~~

~~wherein a, b and c are each independently about 0.0005 to about 1; and~~

~~wherein x is a number sufficient so that the oxygen present balances the charges of the other elements in the chemo/electro-active material; and~~

~~_____ (b) means for determining an individual electrical response of each chemo/electro-active material upon exposure of the array to the gas mixture;~~

~~_____ wherein at least six chemo/electro-active materials comprise a group of four materials selected from one of the following groups~~

~~_____ the group of chemo/electro-active materials comprising, respectively, $\text{Cr}_a\text{Mn}_b\text{O}_x$, $\text{Mn}_a\text{Ti}_b\text{O}_x$, $\text{Nd}_a\text{Sr}_b\text{O}_x$, $\text{Nb}_a\text{Ti}_b\text{Zn}_c\text{O}_x$, Pr_6O_{11} , and $\text{Ti}_a\text{Zn}_b\text{O}_x$~~

~~_____ the group of chemo/electro-active materials comprising, respectively, $\text{Al}_a\text{Ni}_b\text{O}_x$, $\text{Cr}_a\text{Ti}_b\text{O}_x$, $\text{Fe}_a\text{La}_b\text{O}_x$, $\text{Fe}_a\text{Ni}_b\text{O}_x$, $\text{Ni}_a\text{Zn}_b\text{O}_x$, and $\text{Sb}_a\text{Sn}_b\text{O}_x$~~

~~_____ the group of chemo/electro-active materials comprising, respectively, $\text{Al}_a\text{Ni}_b\text{O}_x$, $\text{Cr}_a\text{Ti}_b\text{O}_x$, $\text{Mn}_a\text{Ti}_b\text{O}_x$, $\text{Nb}_a\text{Ti}_b\text{Zn}_c\text{O}_x$, $\text{Ta}_a\text{Ti}_b\text{O}_x$, and $\text{Ti}_a\text{Zn}_b\text{O}_x$~~

~~_____ the group of chemo/electro-active materials comprising, respectively, $\text{Ga}_a\text{Ti}_b\text{Zn}_c\text{O}_x$, $\text{Nb}_a\text{Ti}_b\text{O}_x$, $\text{Ni}_a\text{Zn}_b\text{O}_x$, $\text{Sb}_a\text{Sn}_b\text{O}_x$, $\text{Ta}_a\text{Ti}_b\text{O}_x$, and $\text{Ti}_a\text{Zn}_b\text{O}_x$~~

~~_____ the group of chemo/electro-active materials comprising, respectively, $\text{Ga}_a\text{Ti}_b\text{Zn}_c\text{O}_x$, $\text{Nb}_a\text{Ti}_b\text{O}_x$, $\text{Ni}_a\text{Zn}_b\text{O}_x$, SnO_2 , $\text{Ta}_a\text{Ti}_b\text{O}_x$, and $\text{Ti}_a\text{Zn}_b\text{O}_x$~~

~~_____ the group of chemo/electro-active materials comprising, respectively, $\text{Nb}_a\text{Ti}_b\text{O}_x$, $\text{Ni}_a\text{Zn}_b\text{O}_x$, $\text{Sb}_a\text{Sn}_b\text{O}_x$, $\text{Ta}_a\text{Ti}_b\text{O}_x$, $\text{Ti}_a\text{Zn}_b\text{O}_x$, and ZnO~~

~~_____ the group of chemo/electro-active materials comprising, respectively, $\text{Cr}_a\text{Mn}_b\text{O}_x$, $\text{Cr}_a\text{Ti}_b\text{O}_x$, $\text{Cr}_a\text{Y}_b\text{O}_x$, $\text{Cu}_a\text{Ga}_b\text{O}_x$, $\text{Cu}_a\text{La}_b\text{O}_x$, and $\text{Fe}_a\text{La}_b\text{O}_x$~~

~~_____ the group of chemo/electro-active materials comprising, respectively, $\text{Al}_a\text{Ni}_b\text{O}_x$, $\text{Cr}_a\text{Mn}_b\text{O}_x$, CuO , $\text{Nd}_a\text{Sr}_b\text{O}_x$, Pr_6O_{11} , and WO_3~~

~~the group of chemo/electro-active materials comprising, respectively,
 $\text{Cr}_a\text{Y}_b\text{O}_x$, $\text{Cu}_a\text{Ga}_b\text{O}_x$, $\text{Cu}_a\text{La}_b\text{O}_x$, $\text{Fe}_a\text{Ti}_b\text{O}_x$, $\text{Ga}_a\text{Ti}_b\text{Zn}_c\text{O}_x$, and $\text{Nb}_a\text{W}_b\text{O}_x$; and~~

~~the group of chemo/electro-active materials comprising, respectively,
 $\text{Cr}_a\text{Mn}_b\text{O}_x$, $\text{Mn}_a\text{Ti}_b\text{O}_x$, $\text{Nd}_a\text{Sr}_b\text{O}_x$, $\text{Nb}_a\text{Ti}_b\text{Zn}_c\text{O}_x$, Pr_6O_{11} , and $\text{Ti}_a\text{Zn}_b\text{O}_x$;~~

~~wherein a, b, c and x are as set forth above; and~~

~~wherein the apparatus determines the concentration within the
multi-component gas mixture of ammonia and one or more nitrogen oxides;
and determines the presence or concentration within the mixture of a
hydrocarbon.~~

wherein at least six of the chemo/electro-active materials in the array
comprise one of the following groups of six materials:

the group of chemo/electro-active materials comprising, respectively,
 $\text{Al}_a\text{Ni}_b\text{O}_x$, $\text{Cr}_a\text{Ti}_b\text{O}_x$, $\text{Mn}_a\text{Ti}_b\text{O}_x$, $\text{Nb}_a\text{Ti}_b\text{Zn}_c\text{O}_x$, $\text{Ta}_a\text{Ti}_b\text{O}_x$, and $\text{Ti}_a\text{Zn}_b\text{O}_x$

the group of chemo/electro-active materials comprising, respectively,
 $\text{Ga}_a\text{Ti}_b\text{Zn}_c\text{O}_x$, $\text{Nb}_a\text{Ti}_b\text{O}_x$, $\text{Ni}_a\text{Zn}_b\text{O}_x$, $\text{Sb}_a\text{Sn}_b\text{O}_x$, $\text{Ta}_a\text{Ti}_b\text{O}_x$, and $\text{Ti}_a\text{Zn}_b\text{O}_x$

the group of chemo/electro-active materials comprising, respectively,
 $\text{Ga}_a\text{Ti}_b\text{Zn}_c\text{O}_x$, $\text{Nb}_a\text{Ti}_b\text{O}_x$, $\text{Ni}_a\text{Zn}_b\text{O}_x$, SnO_2 , $\text{Ta}_a\text{Ti}_b\text{O}_x$, and $\text{Ti}_a\text{Zn}_b\text{O}_x$

the group of chemo/electro-active materials comprising, respectively,
 $\text{Nb}_a\text{Ti}_b\text{O}_x$, $\text{Ni}_a\text{Zn}_b\text{O}_x$, $\text{Sb}_a\text{Sn}_b\text{O}_x$, $\text{Ta}_a\text{Ti}_b\text{O}_x$, $\text{Ti}_a\text{Zn}_b\text{O}_x$, and ZnO ;

wherein a, b and c are each independently about 0.0005 to about 1; and

wherein x is a number sufficient so that the oxygen present balances the charges of the other elements in the chemo/electro-active material;

(b) means for determining an individual electrical response of each chemo/electro-active material upon exposure of the array to the gas mixture; and

(c) means for obtaining, from no information about the gas mixture other than the individual electrical response of the chemo/electro-active materials, a determination related to the presence or concentration of a component in the gas mixture.

22. (currently amended) An apparatus according to Claim ~~1, 4, 7, 10, 13, 16, 19, 20 and/or~~ 21 wherein a chemo/electro-active material further comprises a frit additive.

23. (cancelled).

24. (cancelled).

25. (currently amended) An apparatus according to Claim ~~120~~ or 21 that determines the presence or concentration of a nitrogen oxide and a hydrocarbon in the multi-component gas mixture.

26. (currently amended) An apparatus according to Claim ~~±20~~ or 21 wherein the component gases in the gas mixture are not separated.

27. (currently amended) An apparatus according to Claim ~~±20~~ or 21 wherein the electrical responses of the chemo/electro-active materials are determined upon exposure to only the multi-component gas mixture.

28. (cancelled).

29. (currently amended) An apparatus according to Claim ~~±20~~ or 21 wherein the multi-component gas mixture is emitted by a process, or is a product of a chemical reaction that is transmitted to a device, and wherein the apparatus further comprises means for utilizing the electrical responses for controlling the process or operation of the device.

30. (currently amended) A vehicle for transportation comprising an apparatus according to Claim ~~±20~~ or 21.

31. (currently amended) Equipment for construction, maintenance or industrial operations comprising an apparatus according to Claim ~~±20~~ or 21.

32. (currently amended) An apparatus according to Claim 120 or 21 further comprising heating means for separately heating each chemo/electro-active material.

33. (currently amended) An apparatus according to Claim 120 or 21 wherein each chemo/electro-active material is heated to the same temperature.

34. (currently amended) An apparatus according to Claim 120 or 21 wherein one or more chemo/electro-active materials is heated to a different temperature than the other chemo/electro-active materials.

35. (currently amended) An apparatus according to Claim 120 or 21 wherein the chemo/electro-active materials are on a substrate made from a material selected from the group consisting of silicon, silicon carbide, silicon nitride, and alumina with a resistive dopant.

36. (currently amended) An apparatus according to Claim 120 or 21 wherein the gas mixture comprises an organo-phosphorus gas.

37. (currently amended) An apparatus according to Claim 120 or 21 which may be held in the human hand.

38. (currently amended) An apparatus according to Claim 120 or 21 which is located in the ventilation system of a building or car.

39. (new) An apparatus according to Claim 20 or 21 that determines the presence or concentration of a nitrogen oxide in the multi-component gas mixture.

40. (new) An apparatus according to Claim 20 or 21 that determines the presence or concentration of a hydrocarbon in the multi-component gas mixture.

41. (new) An apparatus according to Claim 20 or 21 that determines the presence or concentration of ammonia in the multi-component gas mixture.